The Inverse Discrete Fourier Transform (IDFT) may be represented by a transmultiplexer which is illustrated in Fig. 3, the serial data being led parallel to a set of filters $h_k(n)$, k= 0, 1, 2, ..., M-1, after overscanning has been performed, in which M-1 zeros are added to each datum. The filter $h_0(n)$ is hereby a prototype filter whose time domain runs over the length M , all the other filters $h_k(n)$ represent frequency-shifted versions of this prototype filter $h_0(n)$.

$$h_0(n) = \begin{cases} \frac{1}{\sqrt{M}} & \text{für } n = 0, 1, \ldots, M-1 \\ 0 & \text{sonst} \end{cases} \iff H_0(e^{j\theta}) = \frac{1}{\sqrt{M}} \frac{\sin\frac{M\theta}{2}}{\sin\frac{\theta}{2}} e^{-j\theta\frac{M-1}{2}}$$

The other filters $h_k(n)$, k=1,2, M-1 are obtained by shifting the prototype filter $H_0(e^{j\theta})$ by $(2\pi/M)\cdot k$.

$$h_k(n) = h_0(n) e^{j\frac{2\pi}{M}kn} \iff H_k(e^{j\theta}) = H_0\left(e^{j(\theta - \frac{2\pi}{M}k)}\right) \tag{1}$$

In the Figs. 4 and 5, the corresponding Bode's diagram of the prototype filter for an IDF Transform is represented with a block length of M=16. The side lobes differ quite clearly with regard to their amplitudes which drop symmetrically relative to the major lobe at $\theta/\pi=0$. By contrast, there is no essential difference to be observed in the frequency responses, the prototype filter being provided with a linear phase in all the side lobes. As a result thereof, the interference spectrum occasioned by any effective channel in a fade-out range resembles the interference spectra occasioned by other effective channels except for a complex scaling factor.

According to Fig. 3, the datum k triggers the filter $h_k(n)$ or $H_k(e^{j\theta})$ respectively. The greatest part of the signal power is transmitted in the band $(k-1)2\pi/M \leq \theta < (k+1)2\pi/M$.

On account of the side lobes of the transmission function $H_k(e^{j\theta})$, a not to be neglected part is also transmitted in the adjacent channels, though. If the power density in a certain frequency range is intended to remain below a certain value, it is not sufficient not to trigger the filter(s) corresponding to this range since the side lobes in the transmission functions of adjacent channels cause the power density to still have a value not to be neglected. In that the side lobes slowly

decay, they turn out to be crosstalk in the neighboring channels, the first side lobe having a maximum which is less than the major lobe by only 13 dB (Fig. 4).

For purposes of clarity, only the amplitudes and the phases of the transmission functions for the channels k=2, 3 and 13 are illustrated in Figs. 6 and 7 in a frequency range with M=16 subchannels. It is evident from the Figs. 6 and 7 that triggering the three filters shown brings about considerable power densities, not only in their own subchannels but also in the other subchannels on account of the low side lobe attenuation, each channel having an effect on all of the subchannels in the case shown so that a total of fifteen side lobes superimpose in each subchannel. Each subchannel thereby corresponds to a frequency range of $2\pi/16$. When the number of subchannels is substantially higher, the effective adjacent interaction is only limited to the nearest subchannels respectively.

Considering the side lobes of the three transmission functions shown in a subchannel, e.g. $4 \cdot 2\pi/16 \leq \theta < 5 \cdot 2\pi/16$, it is seen that although their maximum has different values, all the overlapping side lobes have a similar curve.

This is evident from the illustration according to Fig. 8 in which all the side lobes of the prototype filter $h_0(n)$ for M=16 are scaled to the value 1 and are superimposed in the frequency range. All the side lobes have a similar curve with regard to their amplitude spectrum.

As can already be surveyed from the equation 1, the prototype filter and all the other shifted filters have a linear phase. In Fig. 7, the phase curves for the transmission functions of three different subchannels are reproduced, they all have the same gradient and may be transferred into each other by adding a constant phase.

In the frequency band shown it may be necessary to lower the power density of certain forbidden ranges in such a manner that they cannot interfere with already existing transmitting ranges e.g., amateur radio and rescue radio. A concrete example for such a reduction may consist in reliably reducing the power density in a range of 7 to 7.1 MHz from -60 dBm to -80 dBm (VDSL).

In the following it will first be assumed that the fade-out range is localized exactly between two subcarriers k and k+1 so that the corresponding frequency range lies between $k \cdot 2\pi/M \leq \theta < (k+1)2\pi/M$. The two assumed carriers k and k+1 transmit the major portion of their transmitter performance in the selected fade-out range and must therefore be zeroed in any case. Carriers that are located farther away, e.g. k-1, k-2, k+2, k+3 do not act on the frequency range to be faded out by their major lobe but by their side lobes. Accordingly, the overall interference of the adjacent carriers may be calculated by the complex summation of all the side lobes that are still relevant in regard to intensity.

The interference of an adjacent channel with the fade-out range is the datum of the adjacent channel multiplied by the action of the side lobe in the fade-out range.

Fig. 9 represents the interferences of the adjacent channels for a system with M=8 subcarriers. The selected fade-out range is $2 \cdot 2\pi/8 \leq \theta < 3 \cdot 2\pi/8$. Carriers 2 and 3 are zeroed, the occupancy of the remaining carriers is discretional. According to prior art it was up to now common practice to also charge subcarriers located farther outside the immediate fade-out range with zero in order to thus achieve that the side lobes they occasioned be not capable of interfering with the fade-out range. As a result thereof, it was compelling to relinquish a relatively high number of subchannels outside the fade-out range. The realization of the method according to the invention overcomes this disadvantage in the way described herein after.

Since, as already observed herein above, all the side lobes have a similar amplitude curve, the overall interference in the fade-out range must have an amplitude curve that resembles that of the side lobes. This property depends upon the data of the adjacent channels which only determine the maximum and the phase of the overall interference.

It is therefore possible to devise a pulse that has, within the fade-out range, a spectrum that resembles as far as possible the spectrum of the overall interference and to transmit this pulse with the transmitting spectrum. Outside this range, its spectrum should be the smallest possible. The data of the adjacent channels only determine the excitation of the filter.